Upgrade of the superconducting RF cavities at soleil

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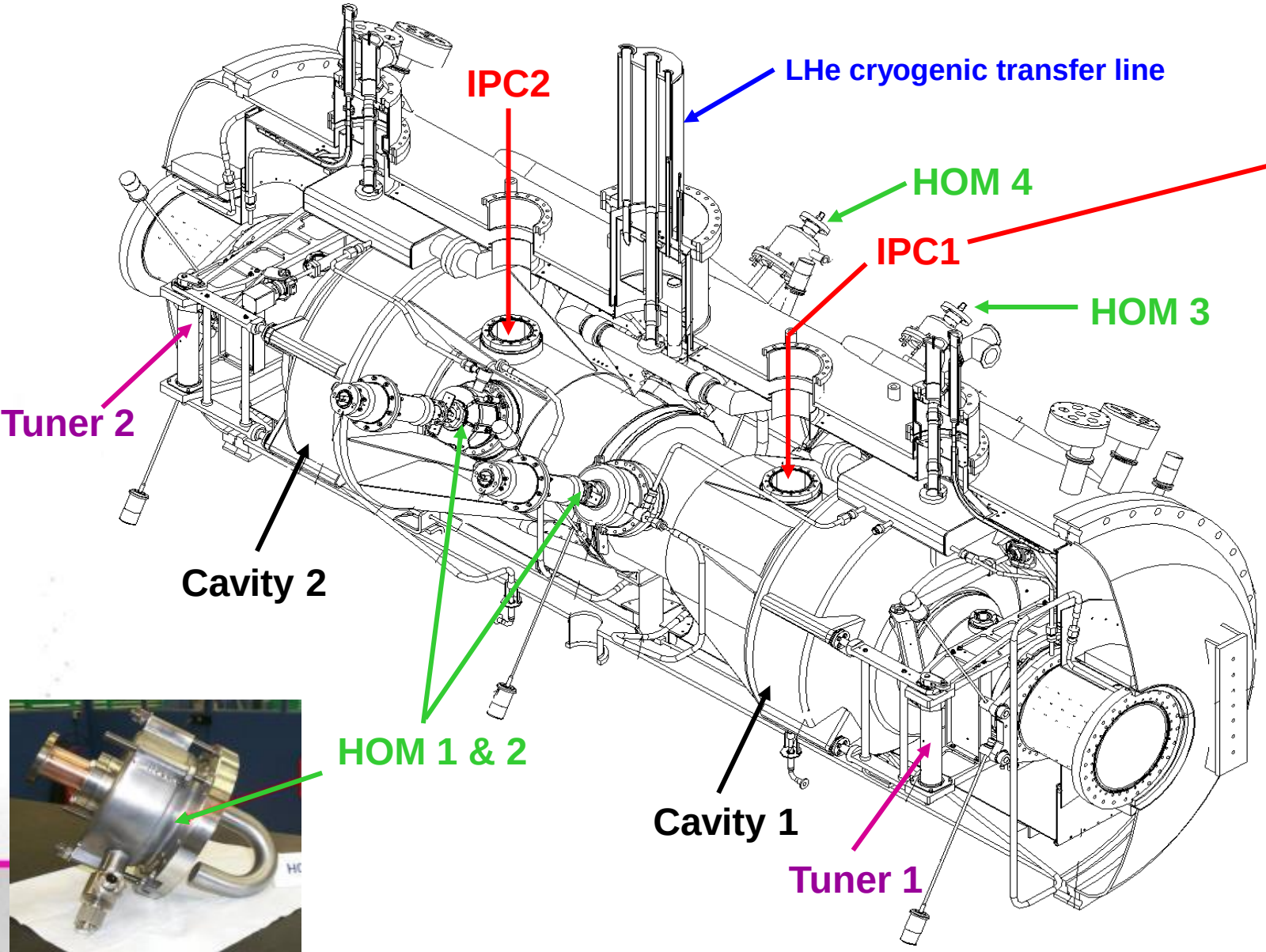
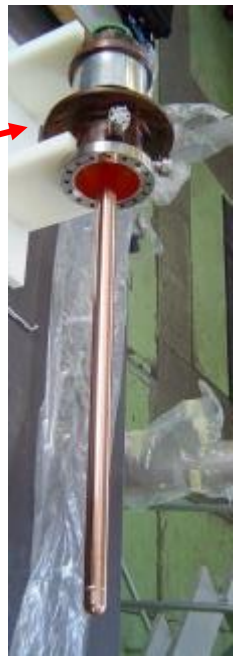
SOLEIL Cryomodule

- E = 2.75 GeV, I_b = 500 mA
  → P_{RF} = 600 kW & V_{RF} = 4 MV @ 352 MHz
- 2 cryomodules (CM), each containing a pair of single-cell s.c. cavities (Nb/Cu)
- Each of the 4 cavities is powered with a 180 kW solid state amplifier
- Both CM's are supplied with LHe (4.2 K) from a single cryogenic plant

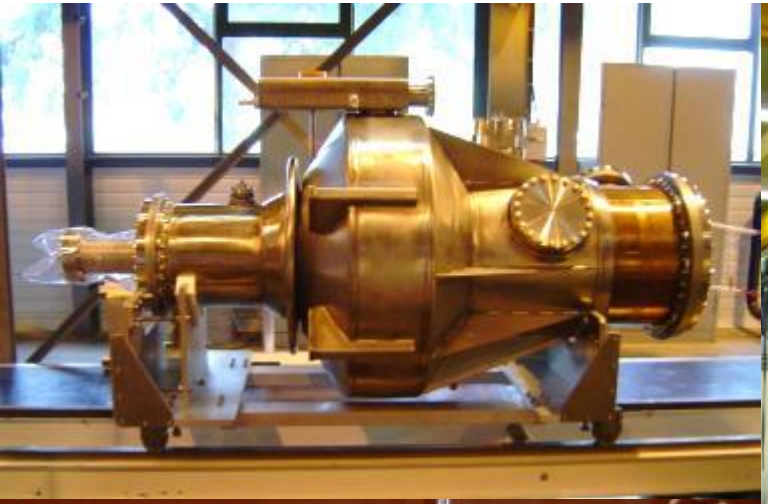
SOLEIL Cryomodule



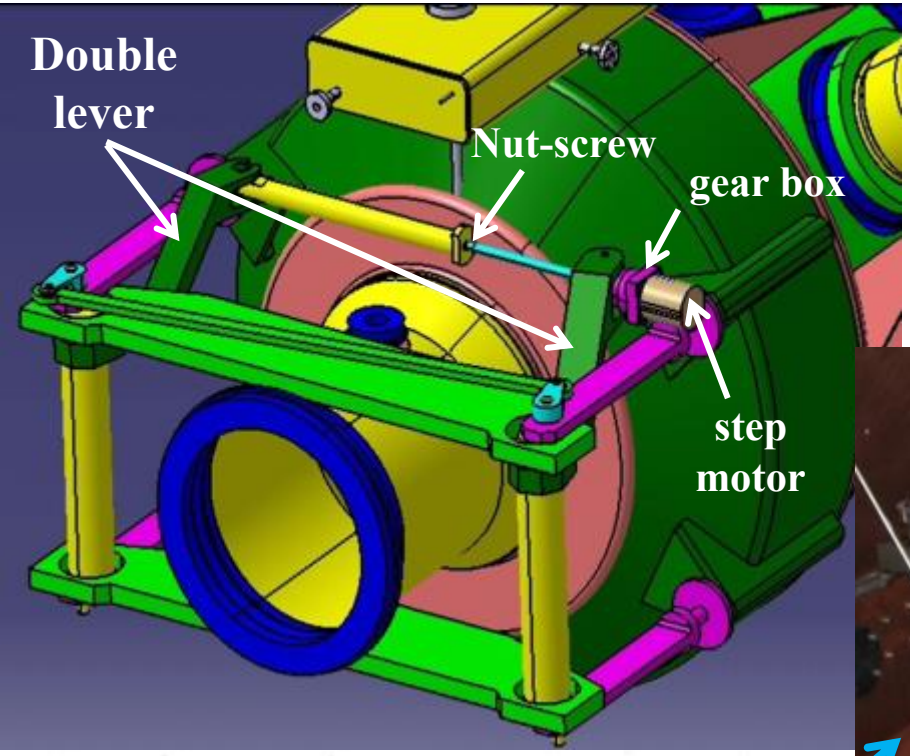


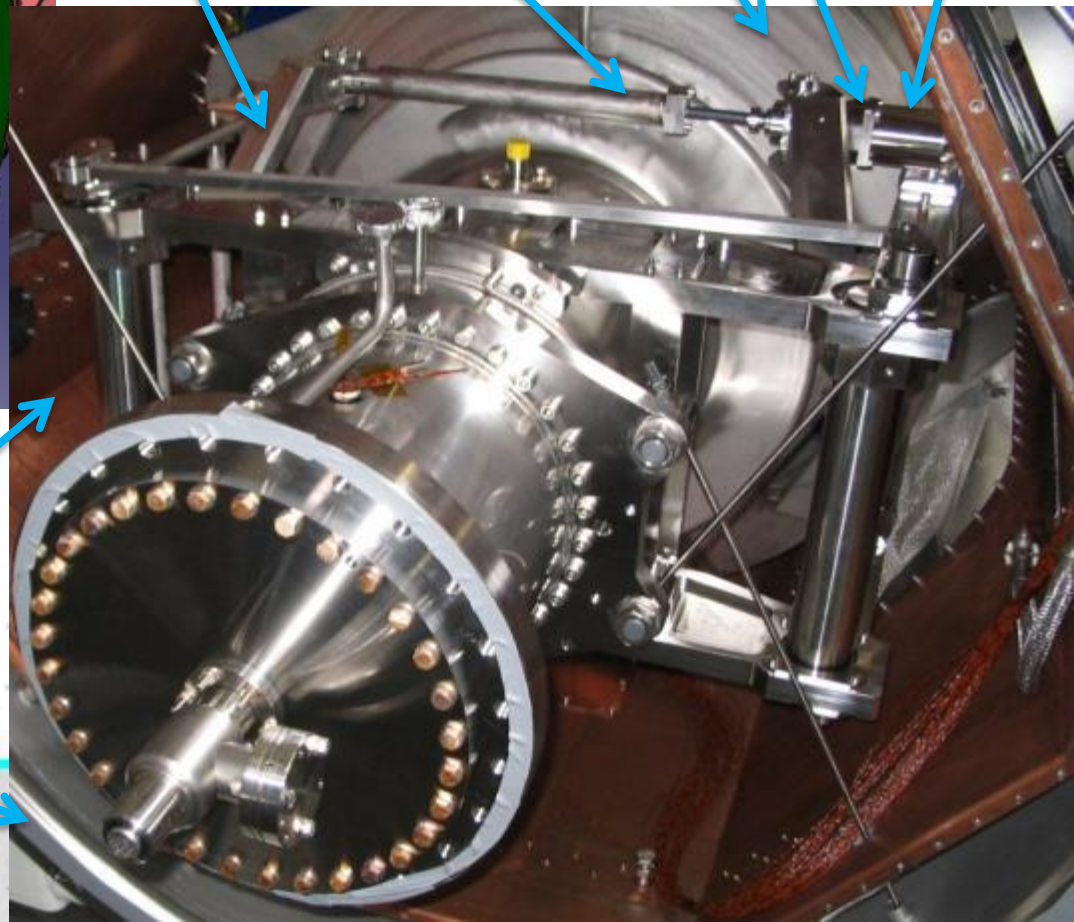
IPC :
Input Power Coupler

SOLEIL Cryomodule

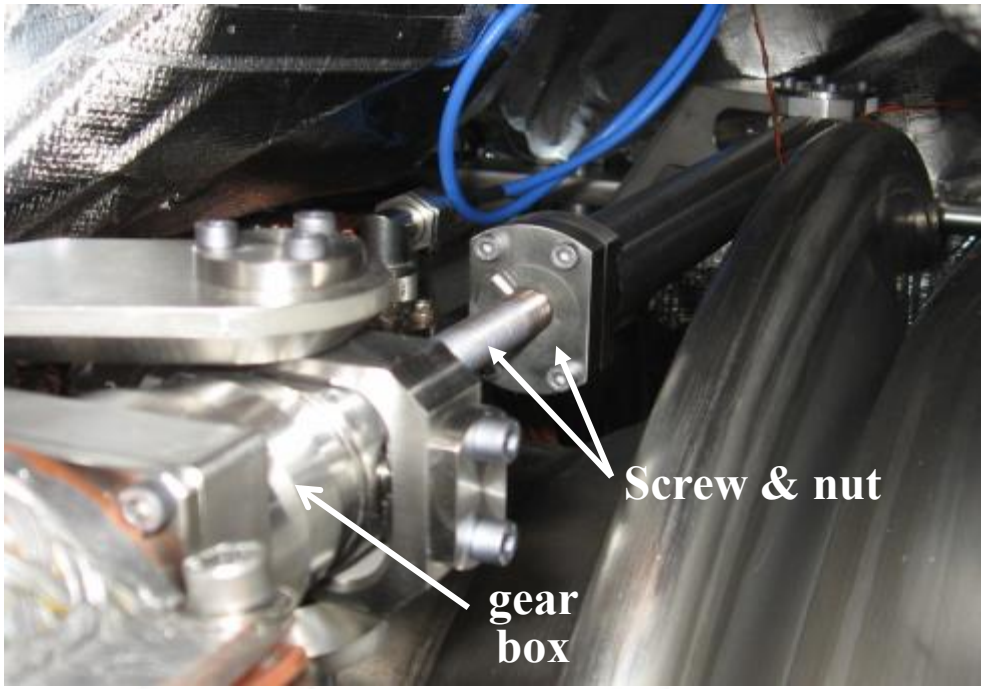


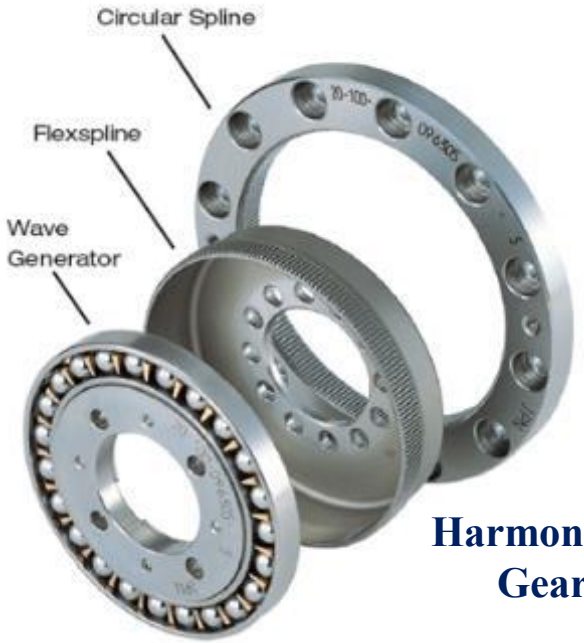
Frequency tuner system





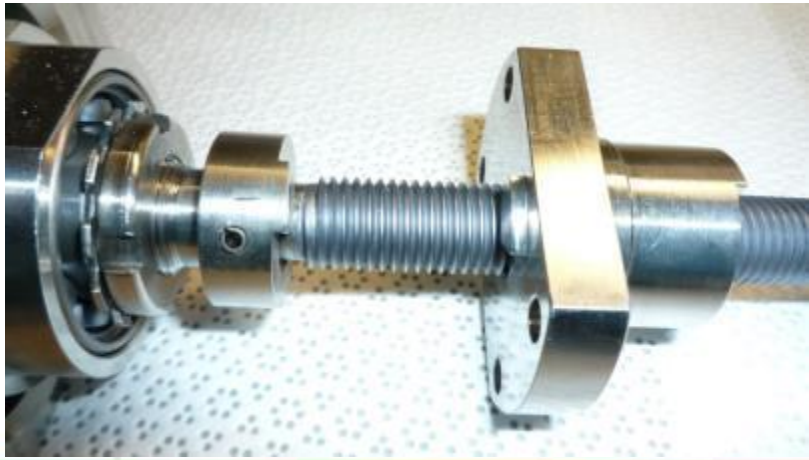
Frequency tuner system





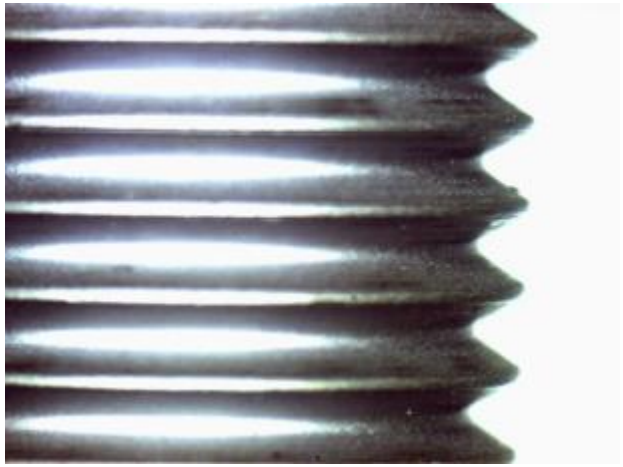
Harmonic drive Gearbox

CuBe2 screw

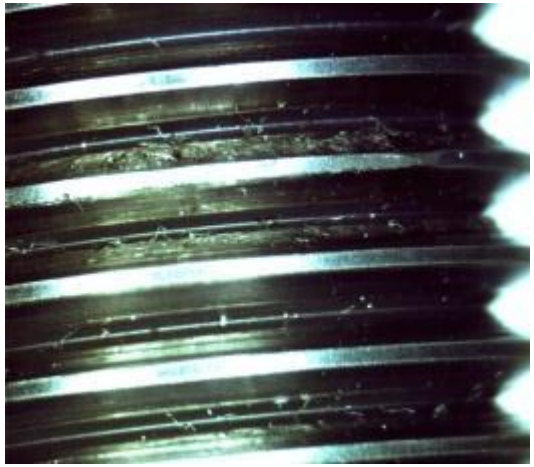


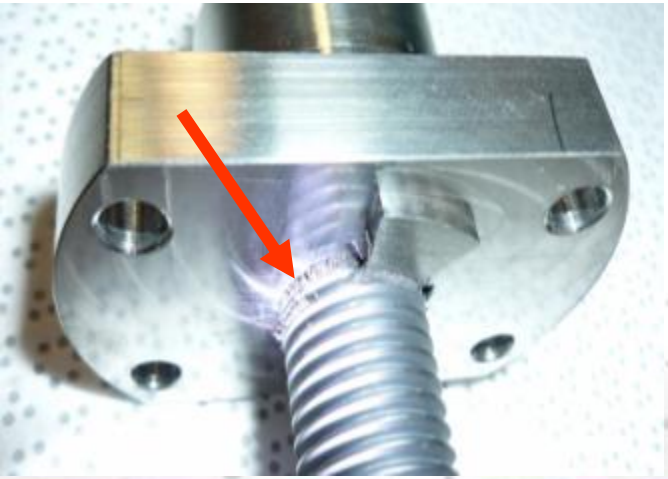
Repetitive jams of the tuners

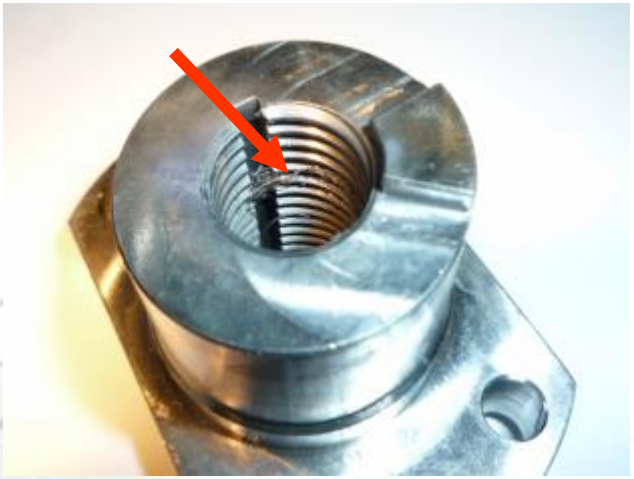
BEFORE:

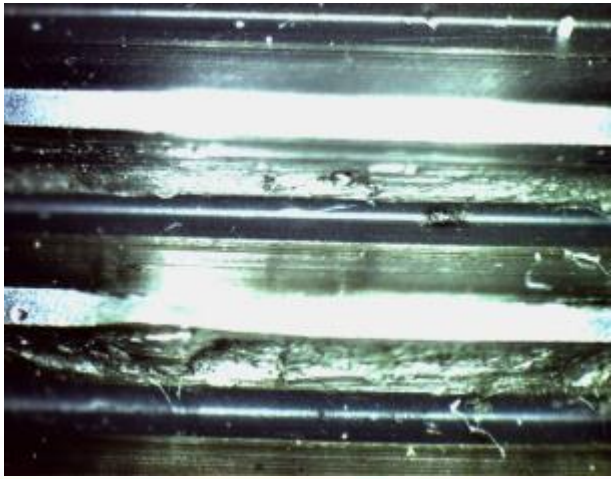


AFTER:









Repetitive jams of the tuners

The standard screw-nut assembly replaced by a *planetary roller screw*

The « harmon ***ox***

NO MORE FAILURE SINCE !

Less friction and more robust → longer lifetime

A prototype was validated @4K on a test bench at CEA with a reliability test equivalent to ~ 20 years of SOLEIL operation

IPC upgrade

Original SOLEIL IPC is a LEP2 type antenna limited to 200 kW
An improved version was later developed by CERN for the LHC

But why change something which works?

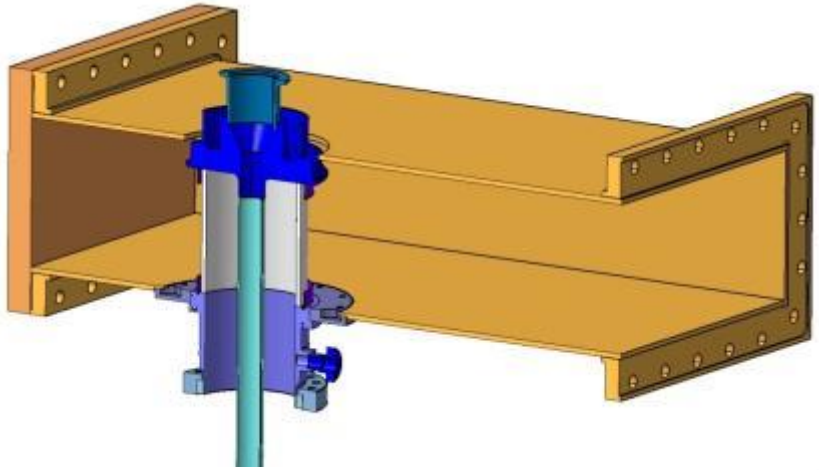
Some problems of ceramic aging with LEP type IPC's at ESRF

Discharges in one of the IPC's, when operating above 120 kW

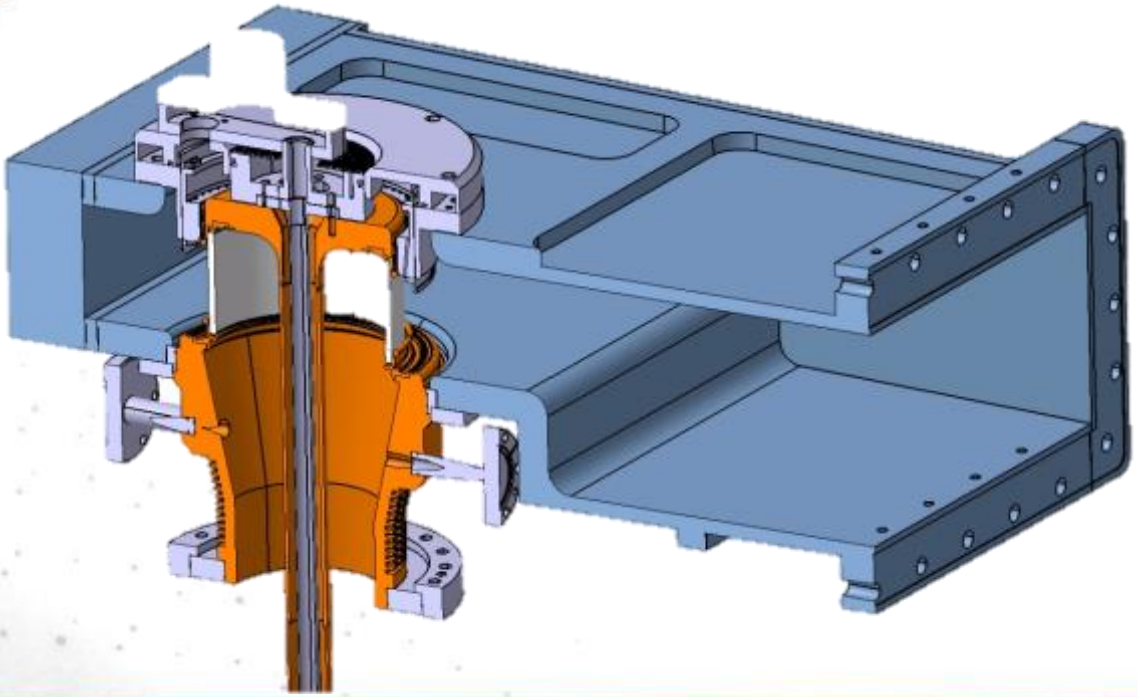
@ 300 kW /cavity → **SOLEIL can store 500 mA using a single CM**

→ **Redundancy**

IPC upgrade

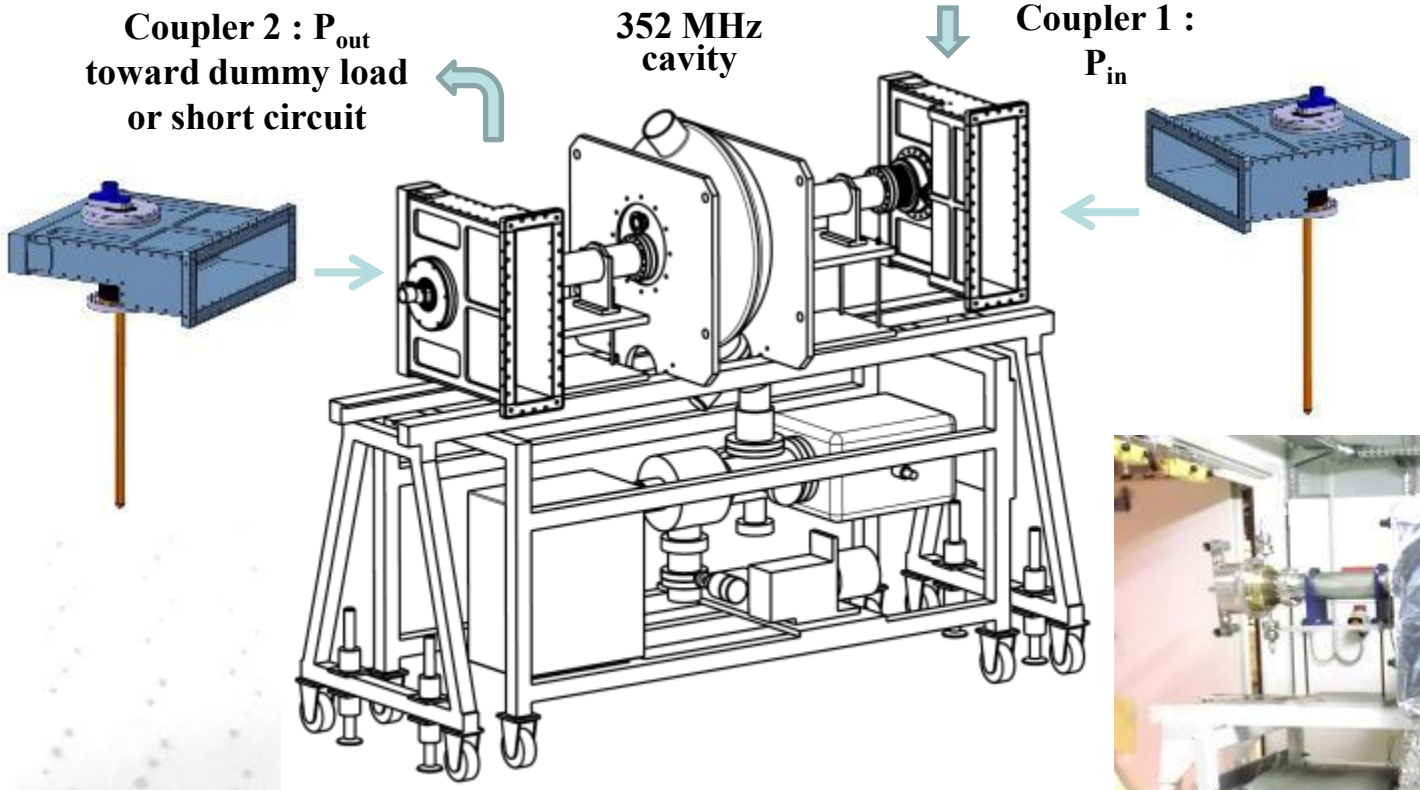


Conclusion of a ***collaboration agreement with CERN and ESRF*** in order to develop a new 352 MHz IPC, based on the LHC design, capable of handling up to ***300 kW***

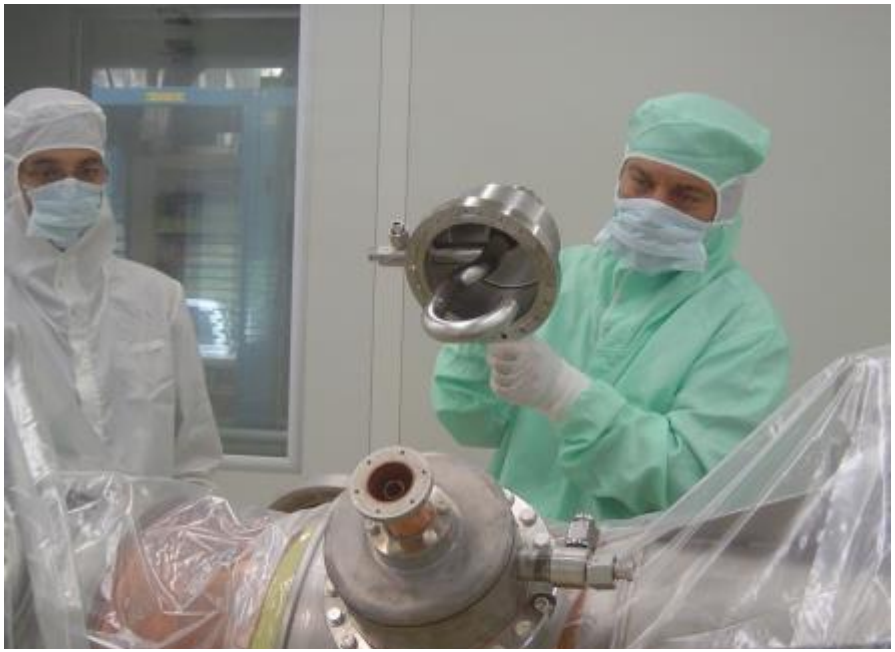


IPC upgrade

April 2013: the 1st pair of upgraded IPC, built at CERN for SOLEIL, is successfully conditioned @300 kW CW in the ESRF test-stand using a Cu cavity from CERN.



IPC upgrade



The initial assembly was done in a ISO-5 (US 100) clean room at CERN

Country and standard	U.S.A. 209D	U.S.A. 209E	Britain BS 5295	Australia AS 1386	France AFNOR X44101	Germany VD I.2083	ISO standard
Date of current issue	1988	1992	1989	1989	1972	1990 onwards	1997
					-	0	
	1	M1.5	C	0.035	-	1	3
	10	M2.5	D	0.35	-	2	4
	100	M3.5	E or F	3.5	4 000	3	5
	1 000	M4.5	G or H	35	-	4	6
	10 000	M5.5	J	350	400 000	5	7
	100 000	M6.5	K	3500	4 000 000	6	8

SOLEIL SYNCHROTRON

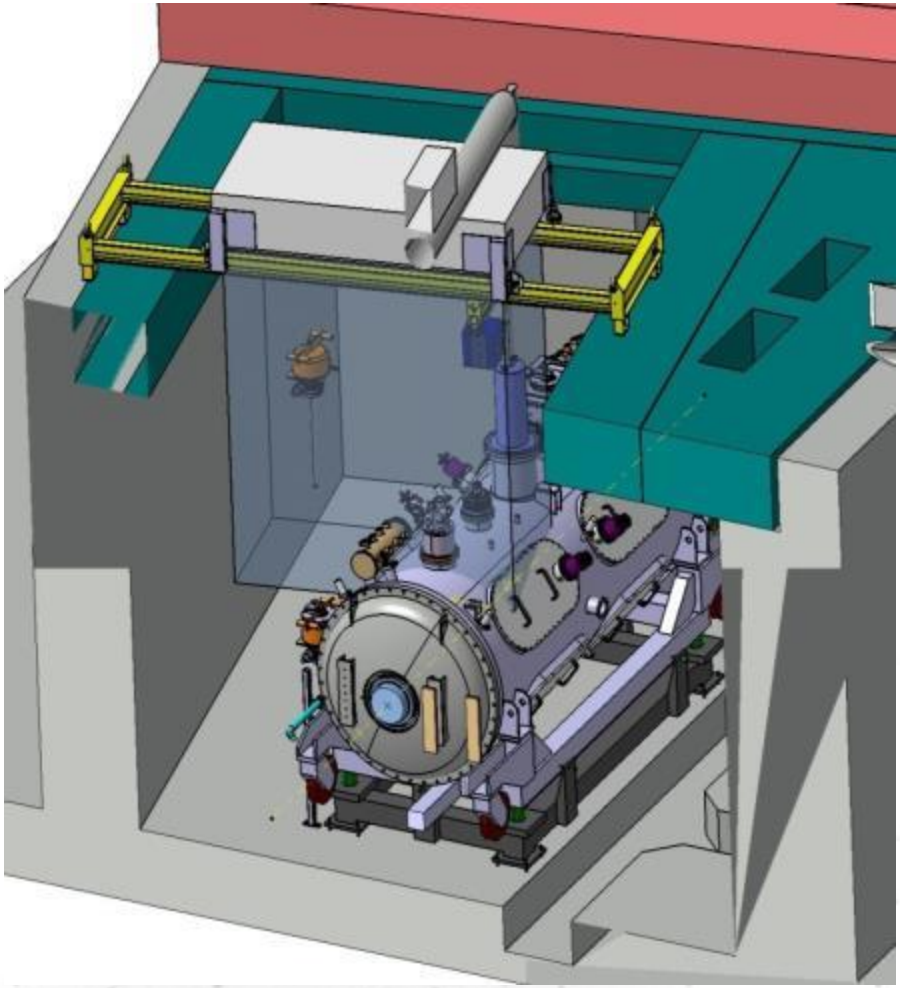
INSIDE

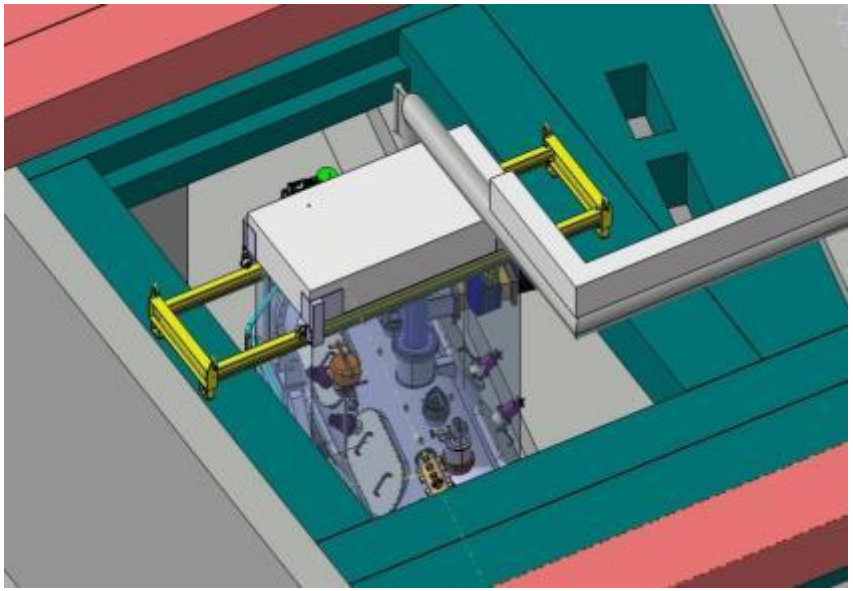
If we can not get the CM to the cleanroom, so we get the cleanroom to the CM !!

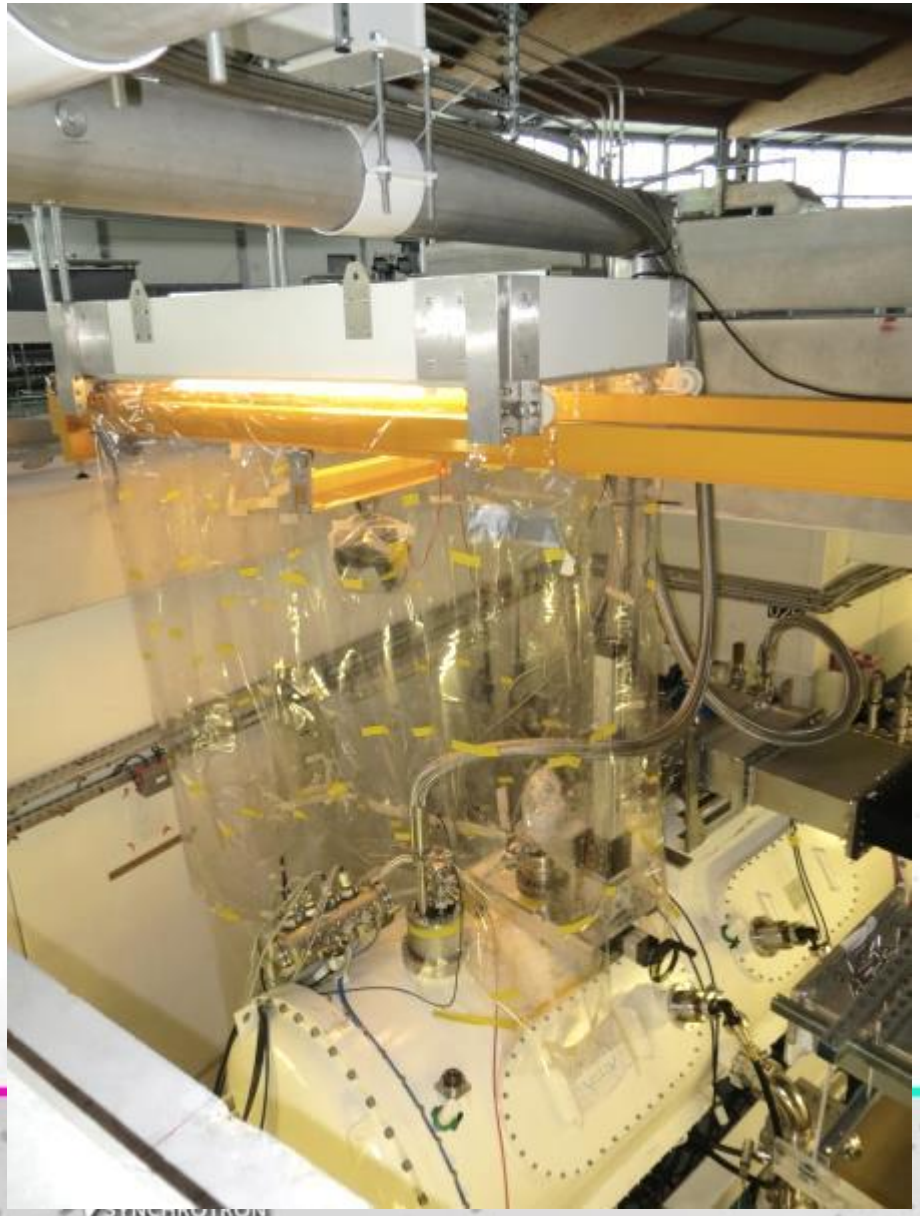
OUTSIDE

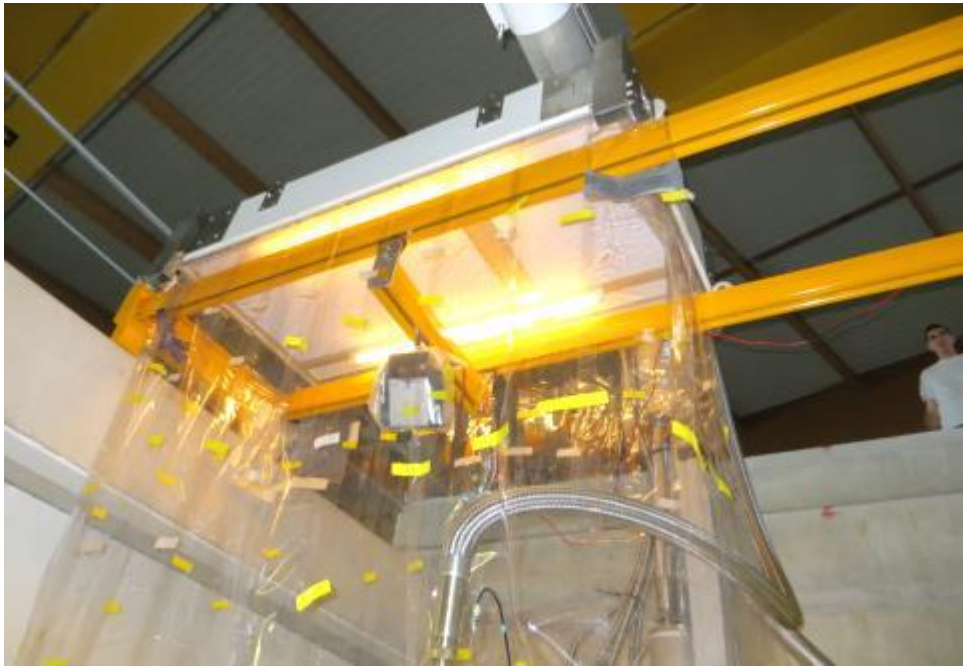
IPC upgrade

IPC upgrade

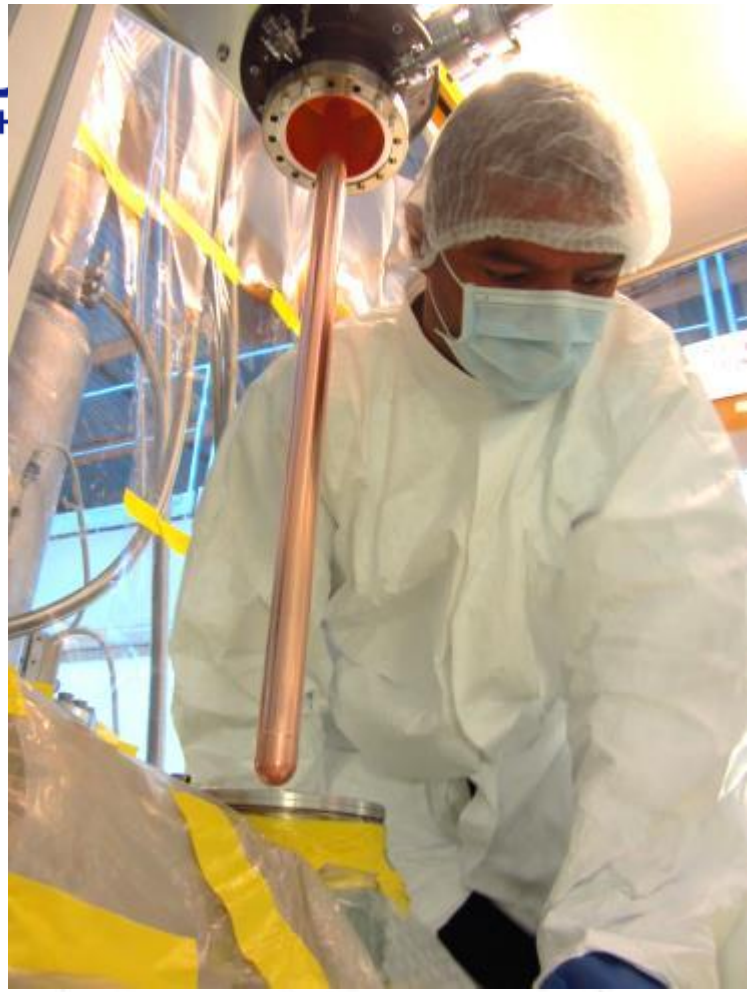








Remove the « old one »



Put on the « new one »

- **August 2013, one of the pre-conditioned IPC is mounted on CM1, under laminar air flow and slight N_2 gas overpressure inside the cavity.**
- **After only few days of RF conditioning, we could store up to 500 mA without any trouble. August 2014: The 2nd IPC has been changes.**

Acknowledgement

All these results have been possible by a strong involvement of all the SOLEIL team:

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